

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

For request for continued examination based on:

Applicants: Fang-An Shu.) Confirmation No. 5863
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Appl. No.: 10/711,864) Examiner: NGUYEN, THANH T
)
Filed: 10/11/2004) Group Art Unit: 2813
)
For: METHOD OF FABRICATING POLY-) TKHR Ref. 251610-1040
CRYSTAL ITO FILMAND) Tsai, Lee & Chen Ref. NP-4747-US
POLYCRYSTALITO ELECTRODE)

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The FINAL Office Action mailed March 1, 2006 has been carefully considered. In response thereto, please enter the following amendments and consider the following remarks.

Amendments to the claims begin on page 2 of this paper.

Remarks begin on page 5 of this paper.

AMENDMENT

In The Claims:

The following list of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Currently amended) A method for fabricating poly-crystal indium tin oxide (ITO) film, the method comprising :

forming an amorphous ITO film on a substrate; and

forming one rapid thermal annealing (RTA) process operated under 400°C-700°C for 0.5-6 minutes, to transform the amorphous ITO film into a poly-crystal ITO film.

2. (Original) The method of claim 1, wherein the step of forming an amorphous ITO film includes sputtering, physical vapor deposition, or chemical vapor deposition.

3. (Original) The method of claim 1, wherein the thickness of the amorphous ITO film is 400-1500 angstroms.

4. (Canceled)

5. (Original) The method of claim 1, wherein the substrate includes glass substrate, silicon substrate, or plastic substrate.

6. (Original) The method of claim 1, wherein the substrate includes rigid substrate, or flexible substrate.

7. (Currently amended) A method for fabricating poly-crystal indium tin oxide (ITO) film, suitable for use to form electrodes in a thin film transistor array, a color filter, a light emitting diode, or an organic electro-luminescence display, the method comprising :

forming an amorphous ITO film on a substrate;

patterning the amorphous ITO film, to form a plurality of amorphous ITO electrodes on the substrate; and

forming one rapid thermal annealing (RTA) process operated under 400°C-700°C for 0.5-6 minutes, to transform the amorphous ITO electrodes into a poly-crystal ITO electrodes.

8. (Original) The method of claim 7, wherein the step of forming an amorphous ITO film includes sputtering, physical vapor deposition, or chemical vapor deposition.

9. (Original) The method of claim 7, wherein the thickness of the amorphous ITO electrode is 400-1500 angstroms.

10. (Original) The method of claim 7, wherein the step of patterning the amorphous ITO film includes:

forming a patterned photoresist layer on the amorphous ITO film;

removing a portion of the amorphous ITO film by using the photoresist layer as a mask, so as to form the amorphous ITO electrodes on the substrate; and removing the photoresist layer.

11. (Original) The method of claim 10, wherein the portion of the amorphous ITO film is removed by oxalic acid.

12. (Canceled)

13. (Original) The method of claim 7, wherein the substrate includes glass substrate, silicon substrate, or plastic substrate.

14. (Original) The method of claim 7, wherein the substrate includes rigid substrate, or flexible substrate.

REMARKS

The Examiner is thanked for carefully reviewing the present application. The present amendment is submitted in response to the FINAL Office Action mailed on March 1, 2006, regarding claims 1-14. The Applicants have thoroughly reviewed the outstanding Office Action, including the Examiner's remarks, and the references cited therein.

Claims 1 and 7 are amended to particularly point out that the RTA process is operated under 400°C -700°C for 0.5-6 minutes. This subject matter was initially embodied in claims 4 and 12, and therefore claims 4 and 12 are correspondingly canceled. As this subject matter was previously considered, in the context of claims 4 and 12, the amendment raises no new issues, and should be entered.

The above amendments and the following remarks are believed to be fully responsive to the Office Action and render all claims at issue patentably distinguishable over cited references. Favorable reconsideration is requested accordingly.

Rejection Under 35 U.S.C. §102(b)

Claims 1-3, 5-11 and 13-14 were rejected under 35 U.S.C. §102(b) as allegedly anticipated by Nakashima et al. (US 2003/0160921) (hereinafter referred to as "Nakashima"). These rejections are rendered moot by the amendment of claims independent claims 1 and 7 to incorporate the subject matter of dependent claims 4 and 12, respectively. Therefore, the remarks in this response will focus on the previous rejections to claims 4 and 12.

The Office Action admitted that "Nakashima et al. does not teach the RTA process for ITO is operated under 400°C - 700°C for 0.5-6 minutes." (Office Action, p. 5). Indeed, Nakashima merely teaches a thermal treatment to heat the amorphous ITO at the temperature

greater 180°C. “Nakashima” does not disclose all of the elements set forth in the present invention. Furthermore, it is well known that the interactions of operating temperature and interval are critical for a RTA process. The performance of the RTA process may vary when the operating interval is changed.

Claim Rejection - 35 U.S.C. §103(a)

The Office Action rejected claims 4 and 12 under 35 U.S.C. §103(a) as allegedly unpatentable over Nakashima in view of Chua et al. (US 2005/0158902) (hereinafter referred to as “Chua”). This rejection is now presumably applicable to independent claims 1 and 7, which have been amended herein to incorporate the subject matter of original claims 4 and 12, respectively. Applicants respectfully request reconsideration and withdrawal of the rejections.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant’s disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

(MPEP §2143)

As stated above, the amended claims 1 and 7 comprise a RTA process is operated under 400°C-700°C for 0.5-6 minutes to transform the amorphous ITO film (electrodes) into a polycrystal ITO film (electrodes). Further, as admitted by the Office Action (p. 5), Nakashima does not teach this feature.

The Office Action, however, alleges that Chua teaches RTA process for ITO is operated under 400°C -700°C for 0.5-6 minutes. Indeed, Chua discloses two RTA processes. However, one of these two RTA processes is a low-temperature anneal operated under 300°C for 2 minutes. The second of these two RTA processes is a high-temperature anneal operated under 600°C. Significantly, only the low-temperature anneal operated under 300°C for 2 minutes hat is used for crystallizing the deposited amorphous ITO film. Therefore, only this process could even be conceivably combinable with Nakashima. Otherwise, the high-temperature anneal is used to induce ohmic contact formation between the ITO film and the p⁺ GaAs contact layer (see Chua paragraph # 59). There exists no proper motivation to combine the high temperature anneal of Chua with Nakashima.

The cited portion of Chua actually states:

[0059] A typical transparent conductor is indium tin oxide ("ITO") which is deposited by a sputtering process prior to etching cavities 126 as described above. This procedure is self-aligned and greatly simplifies fabrication and is enabled by the stability of ITO during the lateral oxidation process (see "Low-threshold InAlGaAs vertical-cavity surface-emitting laser arrays using transparent electrodes" by C. L. Chua et al. in Applied Physics Letters, vol. 72, no. 9, 1001, which is incorporated by reference in its entirety). A half-wavelength thick ITO film is first deposited over the p⁺ GaAs contact layer overlying p-AlGaAs current spreading layer which is grown over DBR layer 114. The ITO film is then successively rapid thermal annealed at 300 and at 600° C. for 2 min each in a nitrogen ambient. The low-temperature anneal crystallizes the deposited amorphous ITO film, while the second, higher-temperature anneal induces ohmic contact formation between the ITO film and the p⁺ GaAs contact layer. The transparent ITO film attains a post anneal contact resistance of 2x10⁻⁵ ohm cm², a sheet resistivity of 5x10⁻⁴ ohm cm, and a power transmission coefficient of 98% at an emission wavelength of 817 nanometers.

Accordingly, even if the low-temperature anneal of Chua was combined with Nakashima, the claimed features are not obtained or disclosed by the combination. For at least this reason, independent claims 1 and 7 patently define over the cited art of record. Since claims

1 and 7 are allowable, dependent claims 2-3, 5-6,8-11 and 13-14, which depend from independent claims 1 and 7 respectively, are also allowable.

As a separate and independent basis for the patentability of claims 1 and 7, Applicants respectfully traverse the rejections as failing to identify a proper basis for combining the cited references. In combining these references, the Office Action stated only that the combination would have been obvious “since it has been held that were the general conditions of a claim are disclosed in the prior art (i.e., poly-crystal ITO film), discovering the optimum or workable ranges involves only routine skill in the art.” (Office Action, page 5, citing *In re Aller*, 105 USPQ 233 (CCPA 1955)). This alleged motivation is clearly improper in view of well-established Federal Circuit precedent.

It is well-settled law that in order to properly support an obviousness rejection under 35 U.S.C. § 103, there must have been some teaching in the prior art to suggest to one skilled in the art that the claimed invention would have been obvious. W. L. Gore & Associates, Inc. v. Garlock Thomas, Inc., 721 F.2d 1540, 1551 (Fed. Cir. 1983). More significantly,

"The consistent criteria for determination of obviousness is whether the prior art would have suggested to one of ordinary skill in the art that this [invention] should be carried out and would have a reasonable likelihood of success, viewed in light of the prior art. ..." Both the suggestion and the expectation of success must be founded in the prior art, not in the applicant's disclosure... In determining whether such a suggestion can fairly be gleaned from the prior art, the full field of the invention must be considered; for the person of ordinary skill in the art is charged with knowledge of the entire body of technological literature, including that which might lead away from the claimed invention."

(Emphasis added.) In re Dow Chemical Company, 837 F.2d 469, 473 (Fed. Cir. 1988).

In this regard, Applicants note that there must not only be a suggestion to combine the functional or operational aspects of the combined references, but that the Federal Circuit also

requires the prior art to suggest both the combination of elements and the structure resulting from the combination. Stiftung v. Renishaw PLC, 945 Fed.2d 1173 (Fed. Cir. 1991). Therefore, in order to sustain an obviousness rejection based upon a combination of any two or more prior art references, the prior art must properly suggest the desirability of combining the particular elements to derive a method of fabricating poly-crystal ITO film, as claimed by the Applicants.

When an obviousness determination is based on multiple prior art references, there must be a showing of some “teaching, suggestion, or reason” to combine the references. Gambro Lundia AB v. Baxter Healthcare Corp., 110 F.3d 1573, 1579, 42 USPQ2d 1378, 1383 (Fed. Cir. 1997) (also noting that the “absence of such a suggestion to combine is dispositive in an obviousness determination”).

Evidence of a suggestion, teaching, or motivation to combine prior art references may flow, inter alia, from the references themselves, the knowledge of one of ordinary skill in the art, or from the nature of the problem to be solved. See In re Dembicza, 175 F.3d 994, 1000, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). Although a reference need not expressly teach that the disclosure contained therein should be combined with another, the showing of combinability, in whatever form, must nevertheless be “clear and particular.” Dembicza, 175 F.3d at 999, 50 USPQ2d at 1617.

If there was no motivation or suggestion to combine selective teachings from multiple prior art references, one of ordinary skill in the art would not have viewed the present invention as obvious. See In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir. 1998); Gambro Lundia AB, 110 F.3d at 1579, 42 USPQ2d at 1383 (“The absence of such a suggestion to combine is dispositive in an obviousness determination.”).

Significantly, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. Winner Int'l Royalty Corp. v. Wang, No 98-1553 (Fed. Cir. January 27, 2000).

For at least the additional reason that the Office Action failed to identify proper motivations or suggestions for combining the various references to properly support the rejections under 35 U.S.C. § 103, those rejections should be withdrawn.

CONCLUSION

In view of the foregoing, it is believed that all pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

No fee is believed to be due in connection with this amendment and response to Office Action. If, however, any fee is believed to be due, you are hereby authorized to charge any such fee to deposit account No. 20-0778.

Respectfully submitted,

By:



Daniel R. McClure
Registration No. 38,962

Thomas, Kayden, Horstemeyer & Risley, LLP
100 Galleria Pkwy, NW
Suite 1750
Atlanta, GA 30339
770-933-9500